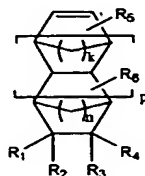


WHAT IS CLAIMED IS:

1 1. A photoresist copolymer derived from a mixture of monomers
2 comprising:

3 (a) two or more alicyclic olefin derivatives of the formula:

4 <Chemical Formula 4>



5 wherein

7 k and n is independently 1 or 2;

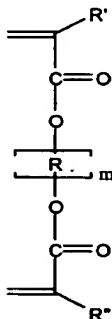
8 p is an integer from 0 to 5;

9 R5 and R6 are independently hydrogen or methyl; and

10 R1, R2, R3, and R4 individually represent hydrogen, straight or branched
11 C₁₋₁₀ alkyl, straight or branched C₁₋₁₀ ester, straight or branched C₁₋₁₀ ketone, straight or
12 branched C₁₋₁₀ carboxylic acid, straight or branched C₁₋₁₀ acetal, straight or branched C₁₋₁₀
13 alkyl including at least one hydroxyl group, straight or branched C₁₋₁₀ ester including at
14 least one hydroxyl group, straight or branched C₁₋₁₀ ketone including at least one hydroxyl
15 group, straight or branched C₁₋₁₀ carboxylic acid including at least one hydroxyl group,
16 and straight or branched C₁₋₁₀ acetal including at least one hydroxyl group,

17 wherein, at least one of R1, R2, R3, and R4 represent straight or branched
18 C₁₋₁₀ alkyl including at least one hydroxyl group, straight or branched C₁₋₁₀ ester including
19 at least one hydroxyl group, straight or branched C₁₋₁₀ ketone including at least one
20 hydroxyl group, straight or branched C₁₋₁₀ carboxylic group including at least one
21 hydroxyl group, straight or branched C₁₋₁₀ acetal including at least one hydroxyl group;
22 and

23 (b) a cross-linking monomer of the formula:



wherein

each of R' and R'' is independently hydrogen or methyl;

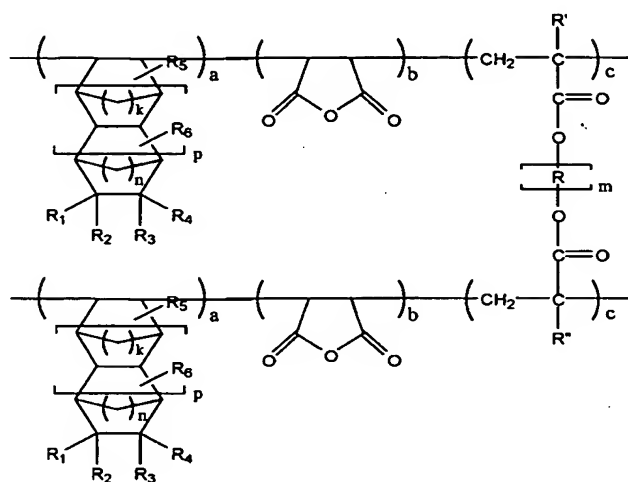
m is an integer from 1 to 10; and

R is straight or branched C₁₋₁₀ alkyl, optionally comprising an ester, a ketone, a carboxylic acid, an acetal, a hydroxyl group or a combination thereof.

2. The photoresist copolymer according to claim 1, wherein said mixture of monomers further comprises maleic anhydride.

3. The photoresist copolymer according to claim 1 of the formula:

<Chemical Formula 5>

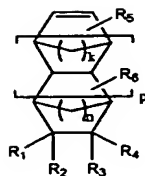


wherein

k, m, n, p, R, R₁, R₂, R₃, R₄, R₅, R₆, R', and R'' are those defined in Claim 1; and the ratio a : b : c is 1-50 mol% : 10-50 mol% : 0.1-20 mol%.

4. The photoresist polymer according to claim 3 comprising poly(maleic anhydride / 2-hydroxyethyl 5-norbornene-2-carboxylate / tert-butyl 5-norbornene-2-carboxylate / 5-norbornene-2-carboxylic acid / 1,3-butanediol diacrylate); or poly(maleic anhydride / 2-hydroxyethyl 5-norbornene-2-carboxylate / tert-butyl 5-norbornene-2-carboxylate / 5-norbornene-2-carboxylic acid / 1,4-butanediol diacrylate).

5. A process for preparing a photoresist copolymer comprising admixing at least two alicyclic monomers, a cross-linking monomer and a polymerization initiator under polymerization reaction conditions sufficient to produce the photoresist copolymer, wherein the alicyclic monomer is of the formula:



wherein

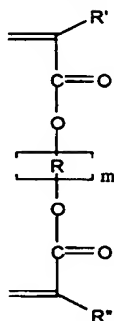
k and n is independently 1 or 2;

p is an integer from 0 to 5;

R_5 and R_6 are independently hydrogen or methyl; and

R_1 , R_2 , R_3 , and R_4 individually represent hydrogen, straight or branched C_{1-10} alkyl, straight or branched C_{1-10} ester, straight or branched C_{1-10} ketone, straight or branched C_{1-10} carboxylic acid, straight or branched C_{1-10} acetal, straight or branched C_{1-10} alkyl including at least one hydroxyl group, straight or branched C_{1-10} ester including at least one hydroxyl group, straight or branched C_{1-10} ketone including at least one hydroxyl group, straight or branched C_{1-10} carboxylic acid including at least one hydroxyl group, and straight or branched C_{1-10} acetal including at least one hydroxyl group,

wherein, at least one of R_1 , R_2 , R_3 , and R_4 represent straight or branched C_{1-10} alkyl including at least one hydroxyl group, straight or branched C_{1-10} ester including at least one hydroxyl group, straight or branched C_{1-10} ketone including at least one hydroxyl group, straight or branched C_{1-10} carboxylic group including at least one hydroxyl group, straight or branched C_{1-10} acetal including at least one hydroxyl group; and the cross-linking monomer is of the formula:



wherein

each of R' and R'' is independently hydrogen or methyl;

m is an integer from 1 to 10; and

R is straight or branched C_{1-10} alkyl, optionally comprising an ester, a ketone, a carboxylic acid, an acetal, a hydroxyl group or a combination thereof.

1 6. The process for preparing a photoresist copolymer according to
2 claim 5, wherein the polymerization reaction is carried out under an atmosphere of
3 nitrogen or argon.

1 7. The process for preparing a photoresist copolymer according to
2 claim 5, wherein the polymerization reaction is carried out at a temperature between 60°C
3 and 130°C.

1 8. The process for preparing a photoresist copolymer according to
2 claim 5, wherein the polymerization reaction is carried out under the pressure between
3 0.0001 and 5 atm.

1 9. The process for preparing a photoresist copolymer according to
2 claim 5, wherein the admixture further comprises an organic solvent selected from the
3 group consisting of cyclohexanone, methyl ethyl ketone, benzene, toluene, dioxane,
4 tetrahydrofuran, propylene glycol methyl ether acetate, dimethylformamide, and a
5 mixture thereof.

1 10. The process for preparing a photoresist copolymer according to
2 claim 5, wherein the polymerization initiator is one or more compound(s) selected from
3 the group consisting of 2,2-azobisisobutyronitrile (AIBN), acetyl peroxide, lauryl
4 peroxide, tert-butyl peracetate, tert-butyl hydroperacetate and tert-butyl peroxide.

1 11. The photoresist composition comprising (i) a photoresist
2 copolymer according to claim 1, and (ii) an organic solvent.

1 12. The photoresist composition according to claim 11, which further
2 comprises a photoacid generator.

1 13. The photoresist composition according to claim 12, wherein the
2 photoacid generator is one or more compound(s) selected from the group consisting of
3 diphenyl iodide hexafluorophosphate, diphenyl iodide hexafluoroarsenate, diphenyl
4 iodide hexafluoroantimonate, diphenyl p-methoxyphenyl triflate, diphenyl p-toluenyl
5 triflate, diphenyl p-isobutylphenyl triflate, diphenyl p-tert-butylphenyl triflate,
6 triphenylsulfonium hexafluorophosphate, triphenylsulfonium hexafluoroarsenate,

7 triphenylsulfonium hexafluoroantimonate, triphenylsulfonium triflate, and
8 dibutylnaphtylsulfonium triflate.

1 14. A process for forming a photoresist pattern, which comprises the
2 steps of (a) coating a photoresist composition according to claim 11 on a wafer, (b)
3 exposing the wafer to patterned light by employing an exposers, and (c) developing the
4 exposed wafer.

1 15. The process for forming a photoresist pattern according to claim
2 14, wherein the step (b) is carried out by using a light source selected from the group
3 consisting of ArF, KrF, E-beam, X-ray, EUV (extremely ultraviolet) and DUV (deep
4 ultraviolet).

1 16. The process according to claim 15, which further comprises baking
2 step(s) before and/or after step (b).

1 17. The process according to claim 16, wherein the baking step(s) are
2 performed at a temperature of 50°C to 200°C.

1 18. The process according to claim 14, wherein the developing step (c)
2 is carried out using an aqueous solution of TMAH (tetramethylamine hydroxide).

1 19. A semiconductor element manufactured by using a process
2 according to claim 14.